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Force-saving stair-climbing electric transport cart

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FORCE-SAVING STAIR-CLIMBING ELECTRIC TRANSPORT CART

Abstract

A force-saving stair-climbing electric transport cart comprises an L-shaped main frame (10) comprising a vertical section and a base (11). Two stair-climbing tracks (20) are mounted to a rear face of the vertical section. Two grounding wheels (14) are mounted to an underside of the base (11). Plural casters (13) rotatably mounted to the underside of the base (11) to allow easy adjustment in the moving direction of the transport cart. Two support rods (40) are pivotally attached to the rear face, each of the support rods (40) being capable of moving rearward with a bottom end thereof pressing against a corner of a wall on a flat surface on top of stairs. Thus, the inclination angle of the transport cart is increased gradually when the tracks (20) of the transport cart reach the flat surface, thereby lifting the transport cart in an easier, quicker, and force-saving manner.

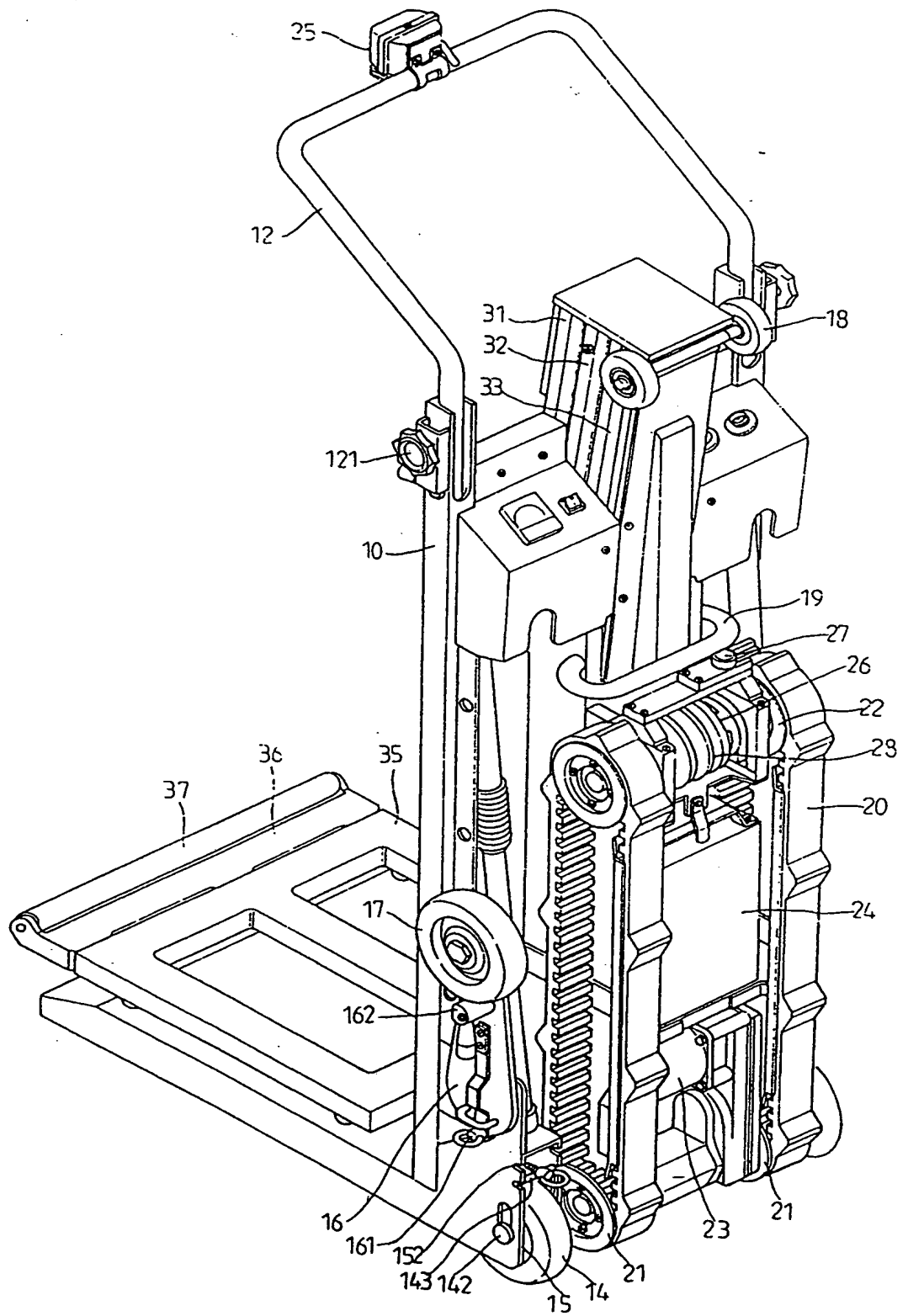


FIG. 2

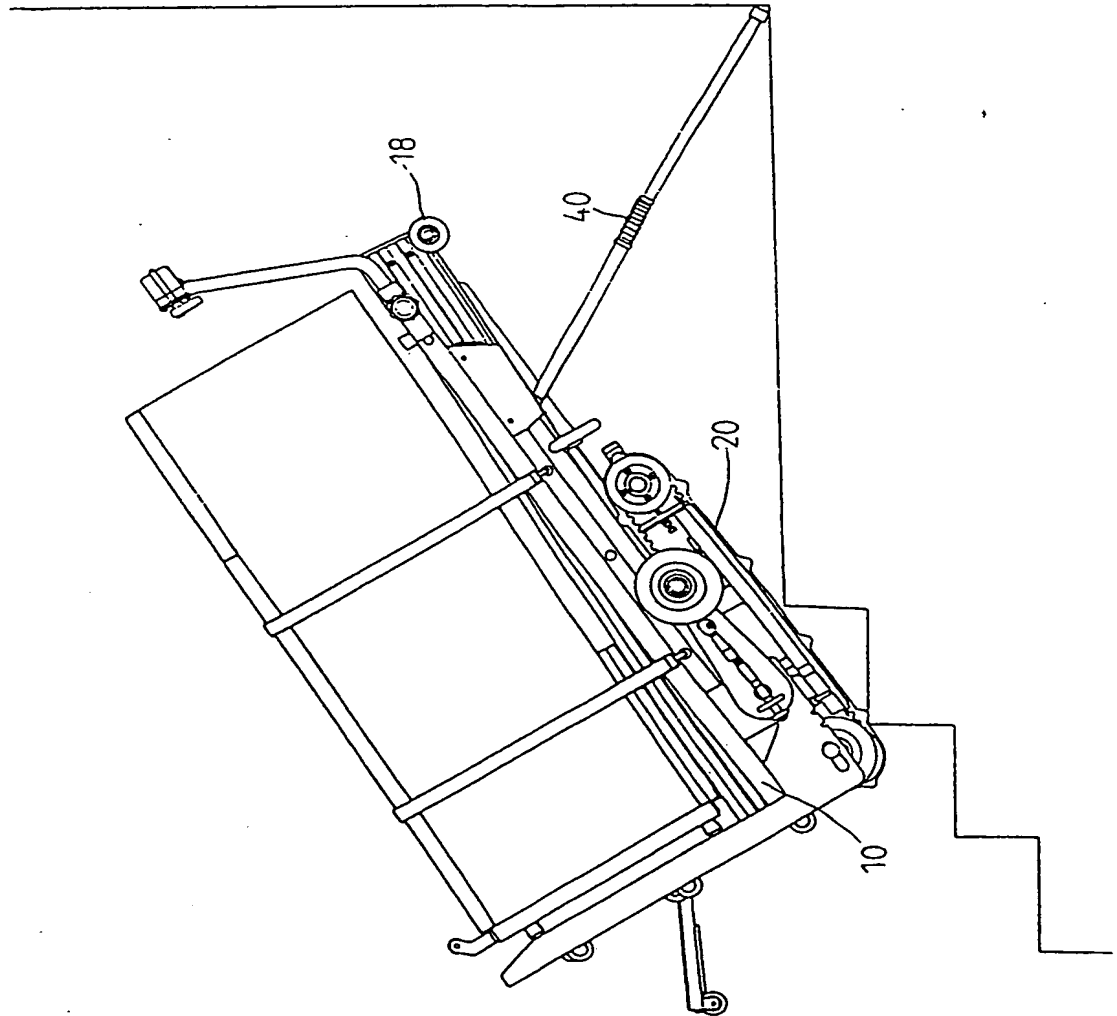


FIG. 21

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title: Force-Saving Stair-Climbing Electric Transport Cart

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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FORCE-SAVING STAIR-CLIMBING ELECTRIC TRANSPORT CART

Background of the Invention

1. Field of the Invention

The present invention relates to a force-saving stair-climbing electric
5 transport cart. In particular, the present invention relates to a force-saving
electric transport cart that may bear heavy load and climb stairs.

2. Description of the Related Art

A transport cart is used to transport heavy objects such as air conditioners,
refrigerators, vaults, and copying machines. The most advanced electric
10 stair-climbing transport cart comprises an upright main frame and a track
mounted to each of two lateral sides of the main frame and driven by a motor.
A clutch mechanism is provided to a positioning roller that is located above
the tracks and that provides transmission. Mounted between the lateral sides of
the main frame is an elevating means comprised of plural elevating members
15 that are stacked along a vertical direction. The elevating means comprises an
actuating cable having an end operably connected to the clutch. The other end
of the cable is extended through the stacked elevating members and a smallest
elevating member and then fixed to a support located above the elevating
means. Thus, by means of controlling the clutch, the electric stair-climbing
20 transport cart may climb stairs or proceed with upward and downward
movement to thereby rise the folding type elevating means to a desired level or
move it to a folded state.

However, when climbing stairs while carrying a heavy load, the transport
cart still has to be moved rearward by the worker to assist the tracks to crawl
25 over the stairs, and when the tracks move to the flat surface on top of the stairs,
the worker has to lift the transport cart to an upright position. Apparently, this,

is not only difficult but also hazardous to manually lift the transport cart in view of the limited area of the flat surface on top of the stairs and the overall weight of the transport cart and the heavy object on the transport cart. In addition, the transport cart will impact the flat surface and thus cause shocks 5 when the transport cart is returned to its upright position. The heavy object tends to be damaged in addition to possible injury to the worker.

Summary of the Invention

An object of the present invention is to provide a force-saving stair-climbing electric transport cart, wherein a support rod is pivotally 10 mounted to each of two sides of a rear face of a vertical section of the main frame. Each support rod may be pivoted rearward with its bottom end pressing against a corner of a wall on a flat surface on top of stairs. Thus, the inclination angle of the transport cart is increased gradually when the tracks of the transport cart reach the flat surface, thereby lifting the transport cart in an 15 easier, quicker, and force-saving manner.

Another object of the present invention is to provide a force-saving stair-climbing electric transport cart, wherein two guide wheels are rotatably mounted to a top of the rear face of the vertical section of the main frame. The guide wheels move against the wall on the flat surface on top of the stairs to 20 assist in further upward movement of the tracks. Thus, the inclination angle of the transport cart is further increased until it is moved to an upright position.

A further object of the present invention is to provide a force-saving stair-climbing electric transport cart, wherein plural casters are mounted to an underside of a base of the main frame to allow easy adjustment in the moving 25 direction on site.

Still another object of the present invention is to provide a force-saving stair-climbing electric transport cart, wherein a movable seat is pivotally attached to the base of the main frame. The movable seat can be moved downward under action of a spring to allow the main frame to stand in an
5 incline state and to provide a cushioning effect when moving the transport cart to its upright position.

Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

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Brief Description of the Drawings

Fig. 1 is a perspective view of a force-saving stair-climbing electric transport cart in accordance with the present invention.

Fig. 2 is a perspective view showing the rear face of the force-saving stair-climbing electric transport cart in accordance with the present invention.

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Fig. 3 is a side view of the force-saving stair-climbing electric transport cart in accordance with the present invention.

Fig. 4 is a rear view of the force-saving stair-climbing electric transport cart in accordance with the present invention.

Fig. 5 is a bottom perspective view of the force-saving stair-climbing
20 electric transport cart in accordance with the present invention.

Fig. 6 is an enlarged view, partly sectioned, of a grounding wheel of the force-saving stair-climbing electric transport cart in accordance with the present invention.

Fig. 7 is a view similar to Fig. 6, wherein the grounding wheel is elevated.

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Fig. 8 is a side view, partly sectioned, of a support rod of the force-saving stair-climbing electric transport cart in accordance with the present invention.

Fig. 9 is an enlarged perspective view of a portion of the support rod in Fig. 8.

Fig. 10 is an exploded perspective view of the portion of the support rod in Fig. 9.

5 Fig. 11 is a side view of the force-saving stair-climbing electric transport cart moving in an inclined state.

Fig. 12 is a side view of the force-saving stair-climbing electric transport cart, wherein a support seat is in an elevated state.

Fig. 13 is a bottom perspective view of the support seat.

10 Fig. 14 is a view similar to Fig. 12, wherein the support seat is further elevated.

Fig. 15 is a perspective view of the force-saving stair-climbing electric transport cart having a ladder attached thereto.

Fig. 16 is a perspective view of the ladder in an opened state.

15 Fig. 17 is a schematic side view illustrating use of the force-saving stair-climbing electric transport cart with a cargo truck.

Fig. 18 is a side view of the force-saving stair-climbing electric transport cart with a movable seat in an operative state.

20 Fig. 19 is an enlarged sectional view of a portion of the force-saving stair-climbing electric transport cart in Fig. 18.

Figs. 20-23 illustrate stair climbing of the force-saving stair-climbing electric transport cart.

Fig. 24 is a schematic view illustrating use of the force-saving stair-climbing electric transport cart for carrying a tall, heavy object.

Detailed Description of the Preferred Embodiment

Referring to Figs. 1 through 5, a force-saving stair-climbing electric transport cart in accordance with the present invention generally includes a substantially L-shaped main frame 10 comprising a pair of electric stair-climbing tracks 20 mounted to two sides of a rear face of a vertical section thereof. The main frame 10 further includes a horizontal section in the form of a base 11 having plural casters 13 attached to an underside of thereof. A front face of the main frame 10 comprises a recessed space (not labeled) for receiving an elevating means comprised of a first elevating member 30, a second elevating member 31, a third elevating member 32, and a fourth elevating member 33 that are stacked along a vertical direction. A decorative cover 34 is fixed to a top of the second elevating member 31. The fourth elevating member 33 is fixed to the main frame 10 to provide a guide for the third elevating member 32. A support rod 40 is mounted to each of two sides of the rear face of the main frame 10 such that the support rod 40 may move rearward.

A handle 12 has two ends respectively fixed to two sides of a top of the main frame 10. A pair of guide wheels 18 is mounted to a top of the rear face of the vertical section opposite to the recessed space. In addition, a rear handle 19 is attached to the rear face of the vertical section and located below the guide wheels 18. The main frame 10 further has a pair of grounding wheels 14, and an arm 16 is pivotally attached to the main frame 10 at a position above the grounding wheels 14. The arm 16 is positioned by a positioning pin 161. A push wheel 17 is pivotally mounted to the other end of the arm 16.

The main frame 10 further has two outer wheel seats 141 for the grounding wheels 14. Referring to Figs. 6 and 7, a shaft 142 of each grounding

wheel 14 is extended through the respective wheel seat 141 and a longitudinal guide groove 151 of a wheel frame portion 15 that forms a part of the main frame 10. An upper engaging notch 152 and a lower engaging notch 153 are defined in an upper portion of the wheel frame portion 15 for selectively engaging with an engaging rod 143 of the wheel seat 141. The engaging rod 143 is pulled to stretch a spring 144 and then engaged with one of the upper engaging notch 152 and the lower engaging notch 153 to thereby retain the respective grounding wheel 14 at a desired level.

A motor 23 and an accumulator 24 are mounted to a lower portion of the rear face of the vertical section of the main frame 10 for driving the tracks 20 and a driving wheel 21 on the lower portion of the vertical section. A clutch 26 is fixed to a shaft (not labeled) of a driven wheel 22. A reel 28 is pivotally connected with the elevating means. A cable 29 has a first end fixed to the reel 28 and a second end passing through the fourth elevating member, 33, the third elevating member 32, the second elevating member 31, and the first elevating member 30 in sequence and then fixed to a top of the elevating means. In operation, a control lever 27 is used to move the clutch 26 to an on position and a switch 25 is pushed to activate the motor 23, thereby driving the tracks 20 to move forward or rearward, yet the elevating means is not moved. If the clutch 26 is in an off position, the motor 23 drives the tracks 20 and the elevating means simultaneously, thereby urging the first, second, third, and fourth elevating members 30-33 to move upward or downward one by one.

Each support rod 40 pivotally mounted to a respective side of the rear face of the vertical section of the main frame 10 comprises an upper rod 41 and a lower rod 42 one of which is telescopically received in the other. In this embodiment, the lower rod 42 is telescopically received in the upper rod 41,

and a telescopic rubber bellow is provided to a joint area between a lower end of the upper rod 41 and an intermediate position of the lower rod 42. Referring to Figs. 8, 9, and 10, a central guide rod 43 is mounted in the upper rod 41 and a spring 44 is mounted around the central guide rod 43 and attached to an upper end of the lower rod 42. Thus, the support rod 40 is telescopic and resilient. A movable arm 51 has an end mounted to an upper end of the upper rod 41. The other end of the movable arm 51 is connected to the main frame 10 via a fixing seat 50 of a coupler. The fixing seat 50 is pivotally connected to the movable arm 51 by a bolt 52. A ball 54 and a spring 55 are mounted in each of two screw holes 53 defined in the fixing seat 50. In addition, an adjusting bolt 56 is mounted in each screw hole 53 to urge the ball 54 to engage with an associated one of a plurality of annularly spaced retaining sockets 57 on each of two lateral sides of the movable arm 51.

Referring to Fig. 11, when moving the transport cart on a flat surface or the ground, the arm 16 is moved rearward such that the push wheels 17 and the grounding wheels 14 are located on the flat surface or ground at the same time.

Referring to Figs. 12 through 14, before operating the elevating means, the push wheels 17 are adjusted to be in contact with the ground and retained in place by the eccentric positioning rods 162. A support seat 35 is fixed to the first elevating member 30 to move therewith. The first elevating member 30 carries the support seat 35 upward and then carries the second elevating member 31 upward. A movable support 36 is mounted to a front end of the support seat 35. As illustrated in Fig. 13, the movable support 36 has a slot 38 in an underside thereof, and a bolt 39 is extended through the front end of the support seat 35 into the slot 38 to thereby prevent disengagement of the movable support 36 when pulling the movable support 36 forward. A roller 37

is rotatably mounted to a front end of the movable support 36 to assist in loading or unloading a heavy object 80.

Referring to Figs. 15 and 16, a ladder 60 is mounted to the front face of the vertical section of the main frame 10 and has an engaging plate 63 at a lower end thereof for engaging with the first elevating member 31. A movable support 61 is attached to a top of the ladder 60 and is secured in place by two buckles 62 on both sides of the ladder 60. A stop plate 67 is pivotally attached to a top of the movable support 61 and can be pivoted to a horizontal position. Further, two hook members 64 project rearward from the top of the movable support 61 and each have an axle 65 formed thereon for releasably mounting a guide wheel 66. In use, the hook members 64 of the ladder 60 are hooked to an edge of a cargo truck to allow ascending or descending movement of the tracks 20 of the transport cart for loading or unloading the cargo, as shown in Fig. 17.

Referring to Figs. 3 through 5, the base 11 of the main frame 10 has a recess 111, and a movable seat 70 and a torsion spring 71 are received in the recess 111 and extended through by a transverse axle 112. Two ends of the torsion spring 71 are respectively attached to the base 11 and the movable seat 70. Mounted inside the movable seat 70 is a push rod 72 that is biased forward by a compression spring 74. Thus, a bearing 73 mounted to a front end of the push rod 72 is retained in place by a stop 113 formed on the underside of the base 11. A cable 76 is attached to a rear end of the push rod 72 at an end, and the other end of the cable 76 is attached to a handle 77 behind the main frame 10. Thus, by means of operating the handle 77, the push rod 72 is moved rearward and thus disengaged from the stop 113, and the movable seat 70 is pivoted outward and downward about the transverse axle 112 under the action of the torsion spring 71, as shown in Figs. 18 and 19. And two rollers 75

mounted to the movable seat 70 are located on the ground for supporting the transport cart in a rearward inclined state.

As illustrated in Fig. 18, the support rods 40 are pivoted rearward, and the tracks 20 of the transport cart are activated to climb upstairs, as shown in Fig. 20. Referring to Fig. 21, when an upper part of each of the tracks 20 has reached a level higher than a flat surface on top of the stairs, the bottom ends of the support rods 40 are attached to a corner of an upright wall on the flat surface. Thus, the tracks 20 of the transport cart may keep moving upward under the support from the support rods 40 to a position shown in Fig. 22. The guide wheels 18 assist in further upward movement of the tracks 20 of the transport cart, and the movable seat 70 provides a cushioning effect, best shown in Fig. 23.

Referring to Fig. 24, when carrying a heavy object 81, the movable support 61 of the ladder 60 is opened until the stop plate 67 rests on top of the heavy object 81. And straps 86 are used to secure the heavy object 81. The guide wheels 66 are rotatably mounted to the movable support 61 so as to be in contact with the wall on the flat surface on top of the stairs, thereby providing a guiding function for upward movement of the tracks 20 of the transport cart.

According to the above description, it is appreciated that the force-saving stair-climbing electric transport cart in accordance with the present invention may climb the stairs smoothly, and it can be lifted to an upright position in an easier, quicker, and force-saving manner. And a cushioning effect is provided when the force-saving stair-climbing electric transport cart is lifted to the upright position.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and

variations can be made without departing from the scope of the invention as hereinafter claimed.



The claims defining the invention are as follows:

1. A force-saving stair-climbing electric transport cart comprising:

an L-shaped main frame comprising a vertical section and a base, the vertical section having front face and a rear face, the rear face having two sides, the base including an underside having two sides;

two stair-climbing tracks mounted to the sides of the rear face and driven by electric control;

two grounding wheels mounted to the sides of the underside of the base;

plural casters rotatably mounted to the underside of the base;

two support rods each of which is pivotally attached by a coupler to an upper portion of an associated one of the sides of the rear face, each of the support rods being capable of moving rearward with a bottom end thereof pressing against a corner of a wall on a flat surface on top of stairs.

2. The force-saving stair-climbing electric transport cart as claimed in claim 1, wherein each said coupler comprises a movable arm and a fixing seat that is pivotally connected to the movable arm, the fixing seat comprising a spring and a ball mounted therein, the movable arm comprising two sides each having a plurality of annularly spaced retaining notches defined therein, the ball being biased by the spring to be engaged in one of the retaining notches in an associated one of the sides of the movable arm, the movable arm further comprising an end fixed to a top of an associated one of the support rods.

3. The force-saving stair-climbing electric transport cart as claimed in claim 1, wherein each said support rod comprises an upper rod and a lower rod one of which is telescopically received in the other, a central guide rod

being mounted in an upper end of the upper rod and extending into the lower rod, a spring being mounted in the upper end of the upper rod and around the central guide rod, the spring being attached to an upper end of the lower rod.

5 4. The force-saving stair-climbing electric transport cart as claimed in claim 2, wherein each said support rod comprises an upper rod and a lower rod one of which is telescopically received in the other, a central guide rod being mounted in an upper end of the upper rod and extending into the lower rod, a spring being mounted in the upper end of the upper rod and
10 around the central guide rod, the spring being attached to an upper end of the lower rod.

15 5. The force-saving stair-climbing electric transport cart as claimed in claim 1, wherein the vertical section of the main frame further comprises two wheel frame portions each having a longitudinal guide groove and a wheel seat, each of the grounding wheels comprising a shaft extending through an associated one of the wheel seats and the longitudinal guide groove of an associated one of the wheel frame portions, an upper engaging notch and a lower engaging notch being defined in an upper portion of each of the wheel frame portions for selectively engaging with an engaging rod of
20 an associated one of the wheel seats, the engaging rod being pulled to stretch a spring and then engaged with one of the upper engaging notch and the lower engaging notch to thereby retain an associated one of the grounding wheels at a desired level.

25 6. The force-saving stair-climbing electric transport cart as claimed in claim 1, wherein the top of the rear face of the vertical section of the main frame comprising two outwardly projecting guide wheels attached thereto.

7. The force-saving stair-climbing electric transport cart as claimed in claim 1, wherein the underside of the base comprises a recess for pivotally receiving a movable seat and a torsion spring, a push rod being mounted in the movable seat and comprising a front end and a rear end, the front end of the push rod being biased by a compression spring and stopped by a stop provided on the underside of the base, a cable having an end attached to the rear end of the push rod and operable by a handle to move the push rod rearward to disengage from the stop, and the torsion spring pushing the movable seat downward and outward.
8. A force-saving stair-climbing electric transport cart, substantially as herein described with reference to any one of the embodiments of the invention shown in the accompanying drawings.

Dated 25 October, 2001

Chu-Hsiung Lu

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

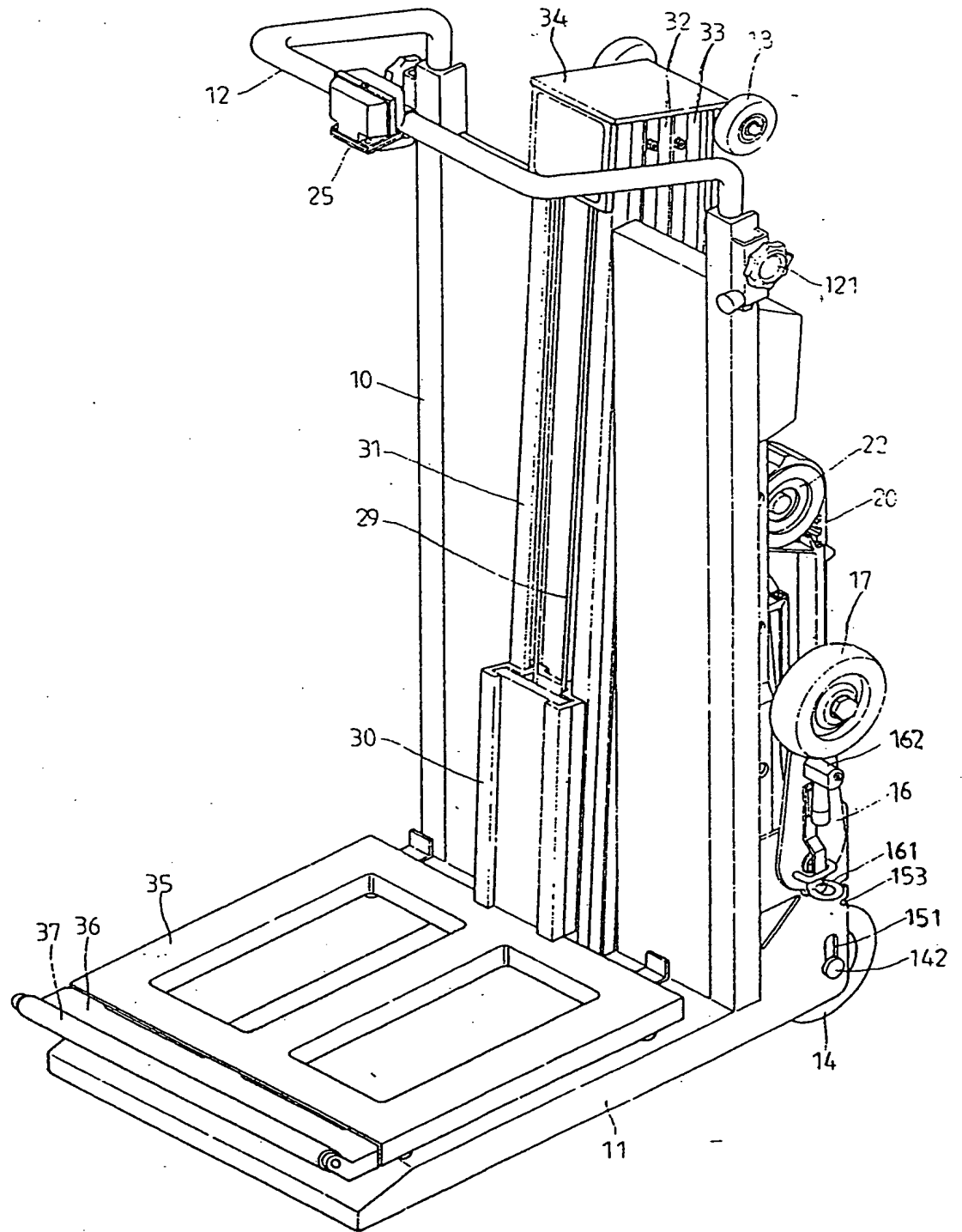


FIG. 1

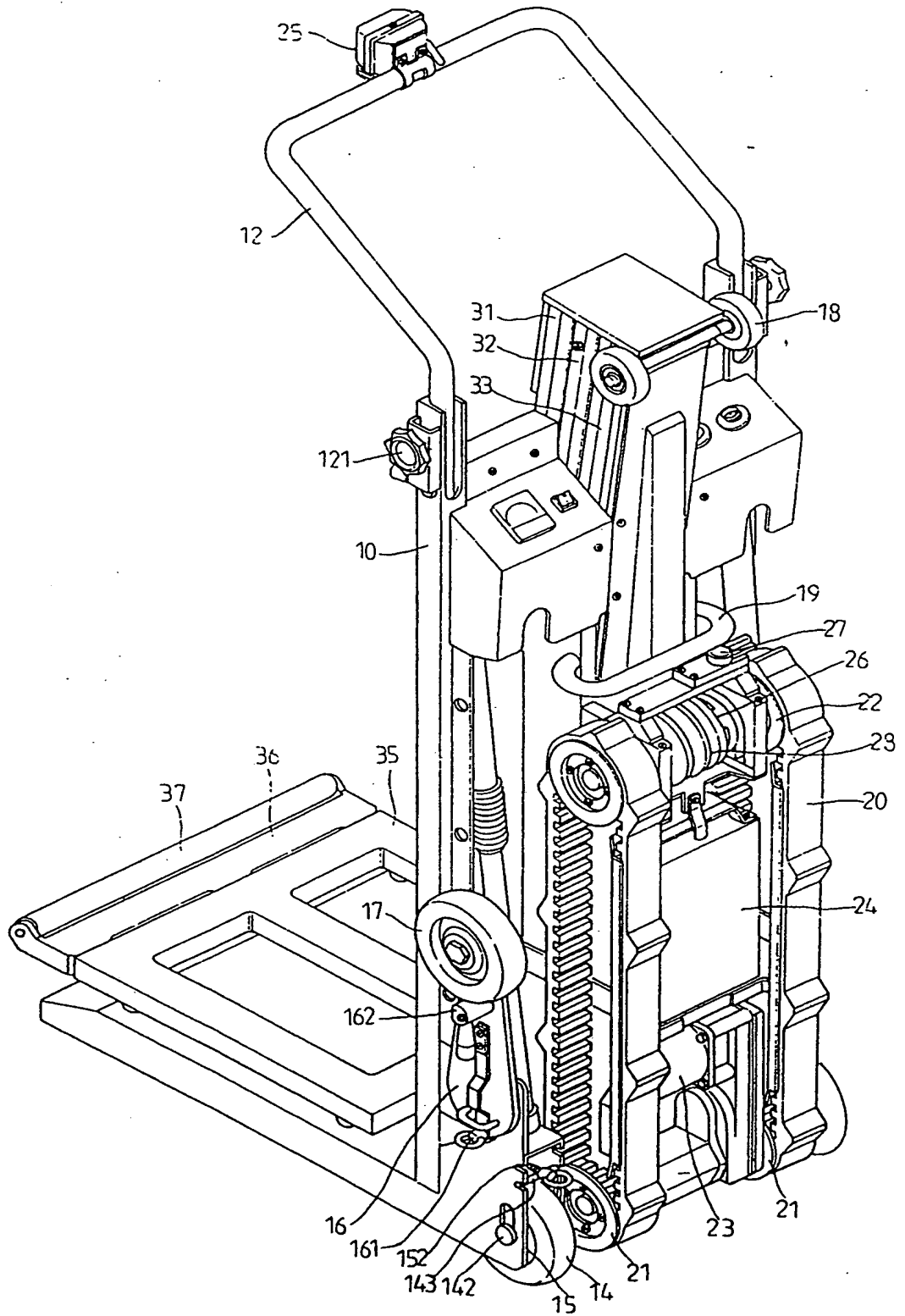
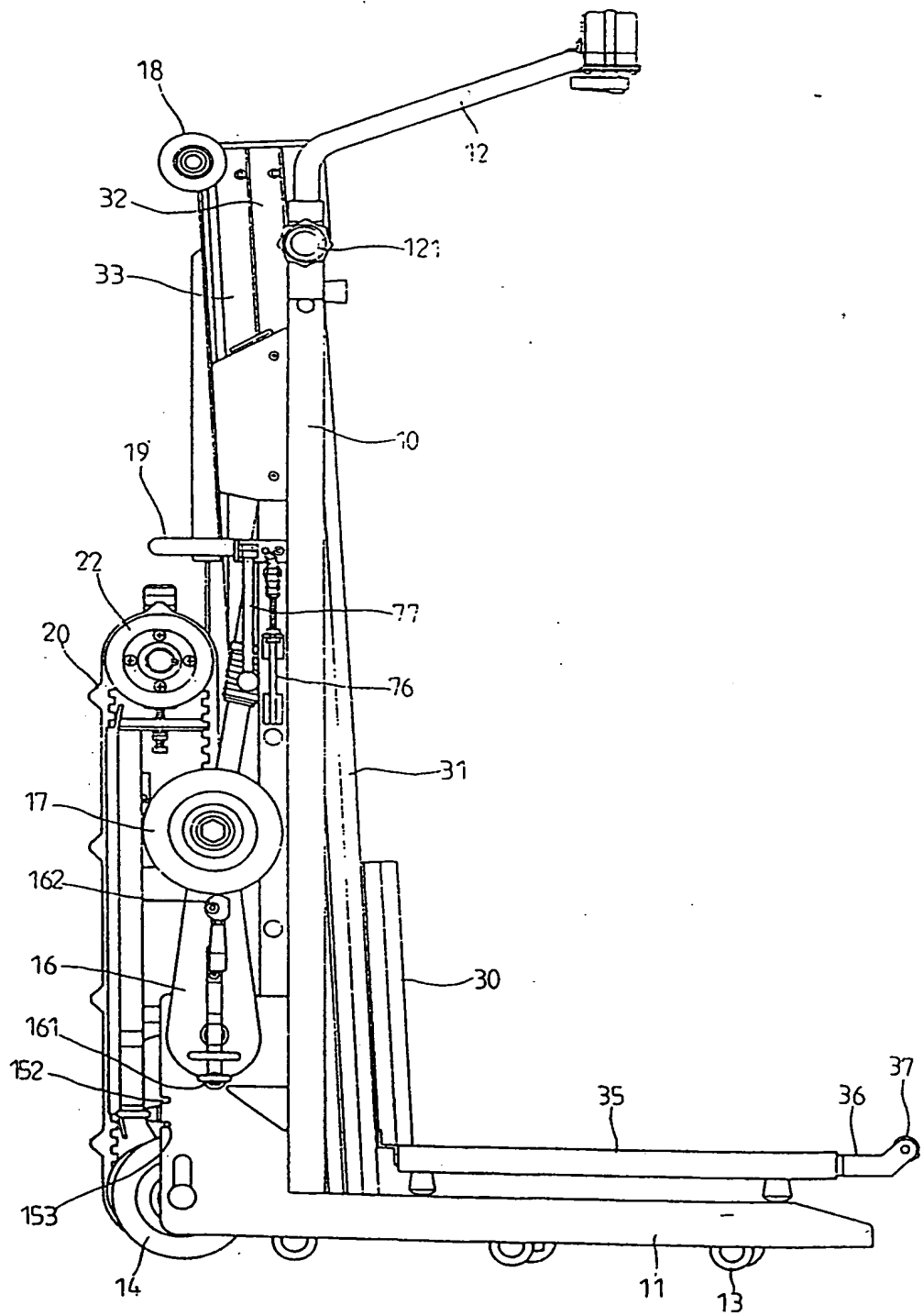


FIG. 2

**FIG. 3**

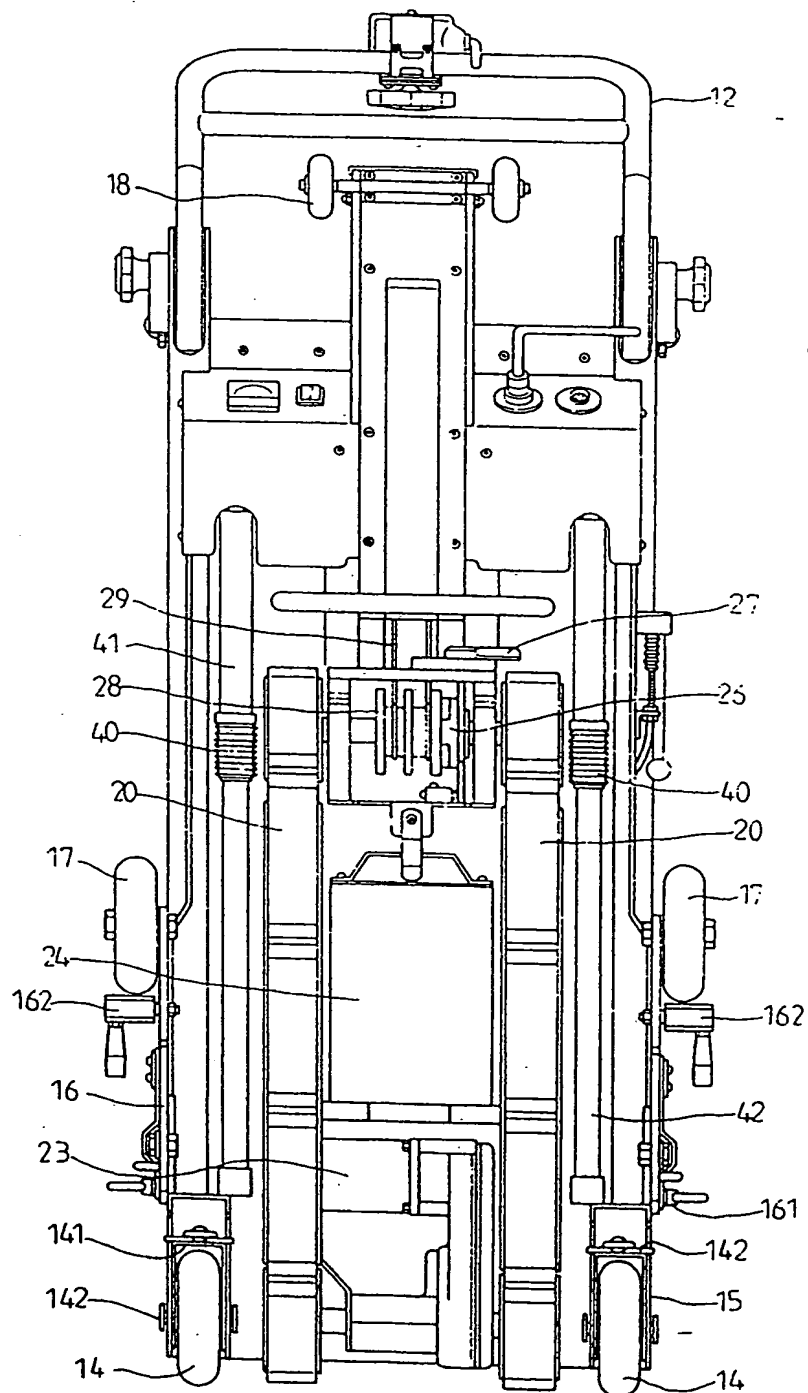


FIG. 4

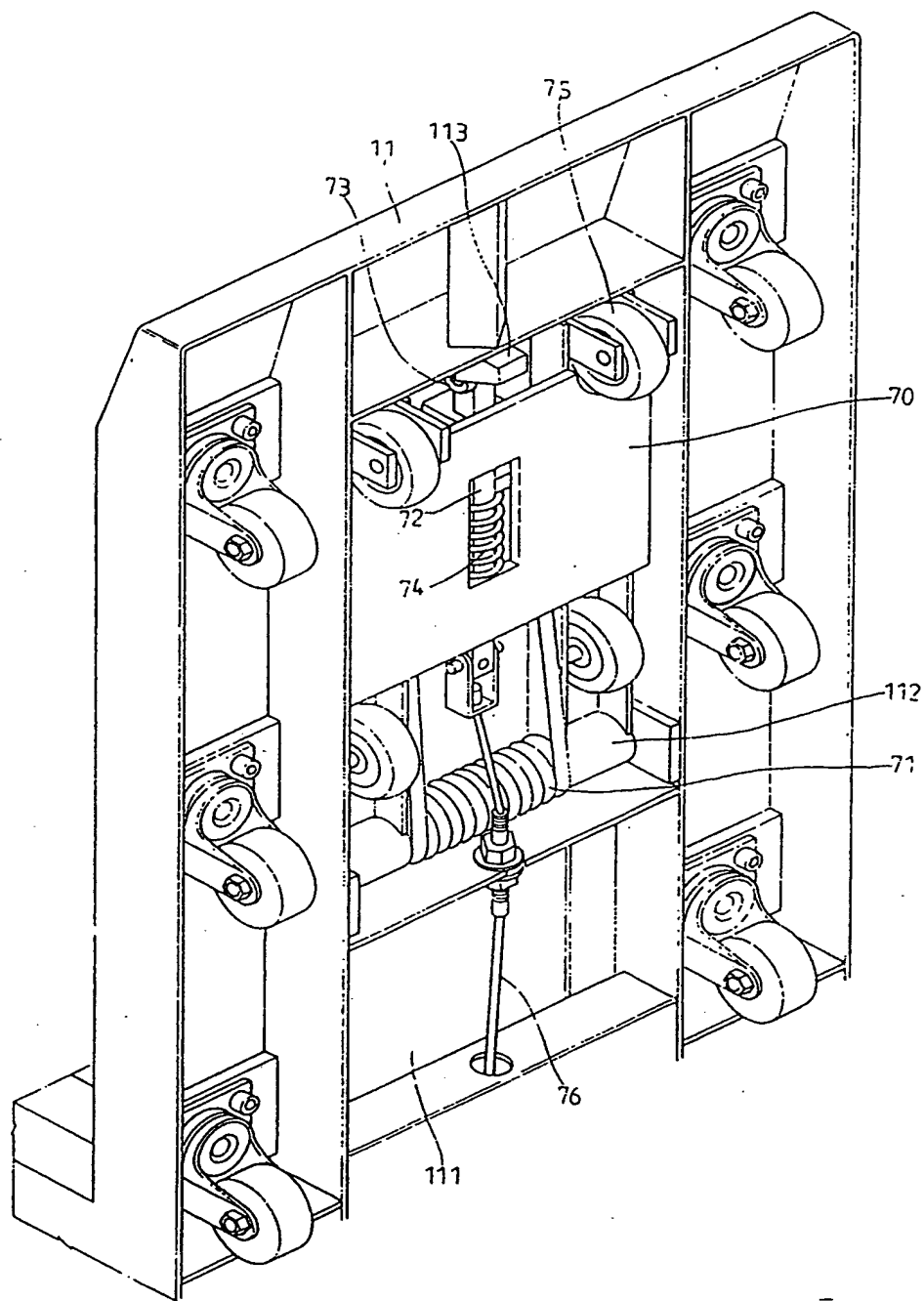


FIG. 5

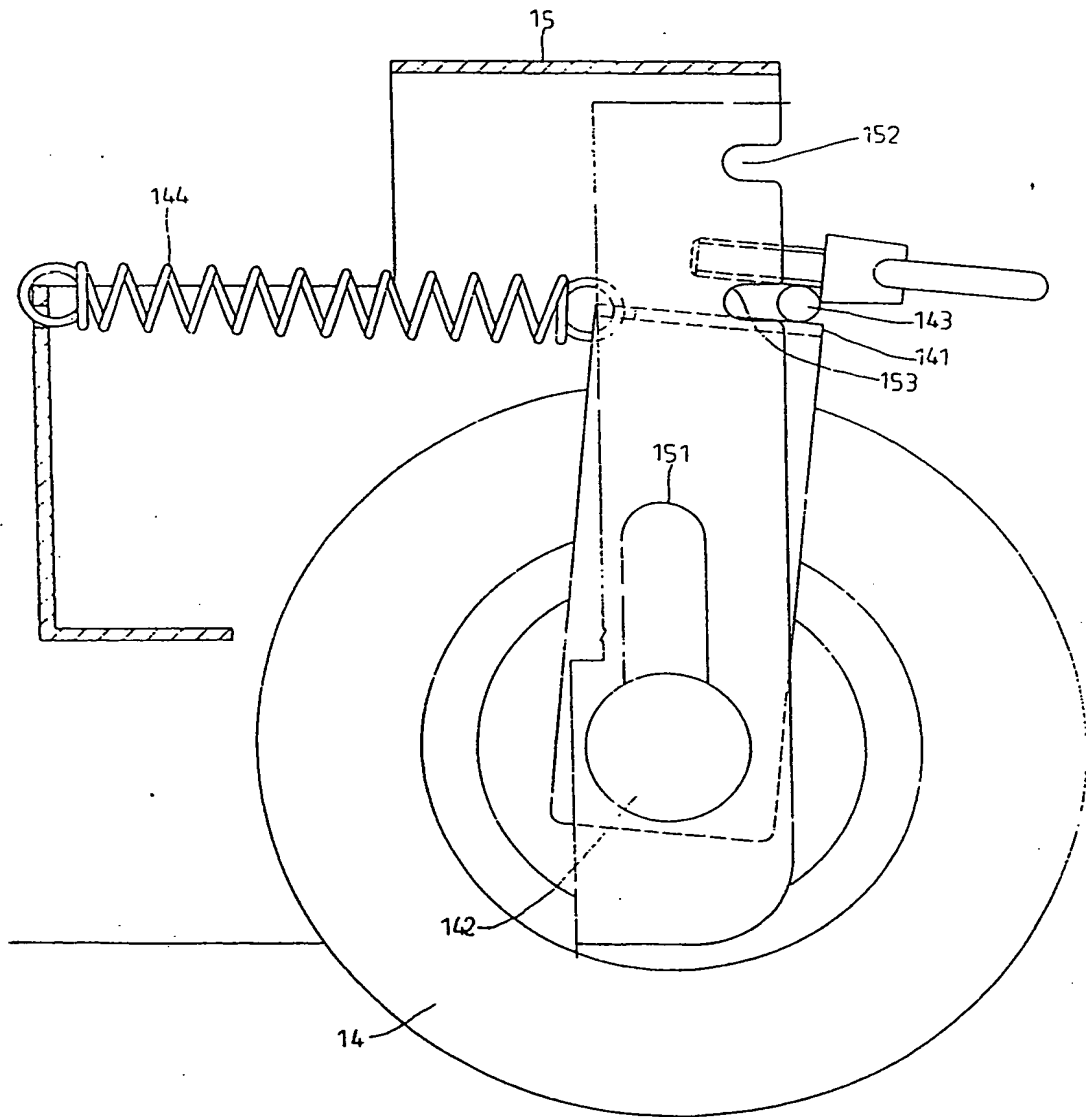


FIG. 6

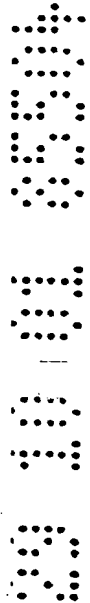


Figure 1 shows four types of 2D hexagonal lattices: (a) Hexagonal lattice, (b) Honeycomb lattice, (c) Kagome lattice, and (d) Triangular lattice. Each lattice is represented by a set of black dots (sites) and lines (bonds) forming a hexagonal pattern. The lattices are arranged in a 2x2 grid. The hexagonal lattice (a) has a central site connected to six surrounding sites. The honeycomb lattice (b) has a central site connected to three surrounding sites. The kagome lattice (c) has a central site connected to three surrounding sites in a non-trivial arrangement. The triangular lattice (d) has a central site connected to six surrounding sites in a triangular arrangement.

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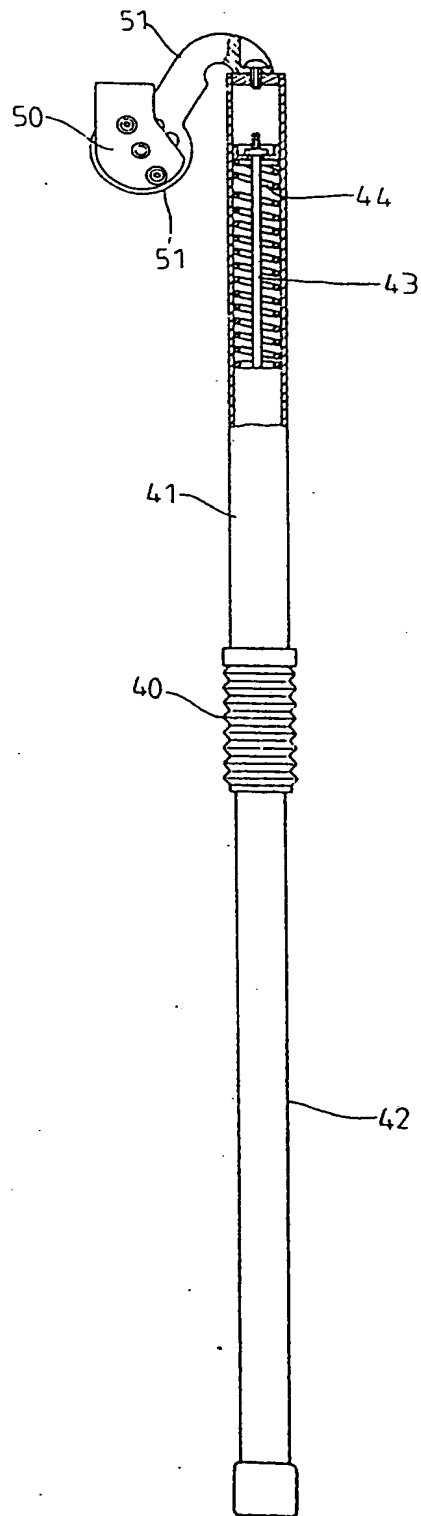


FIG. 8

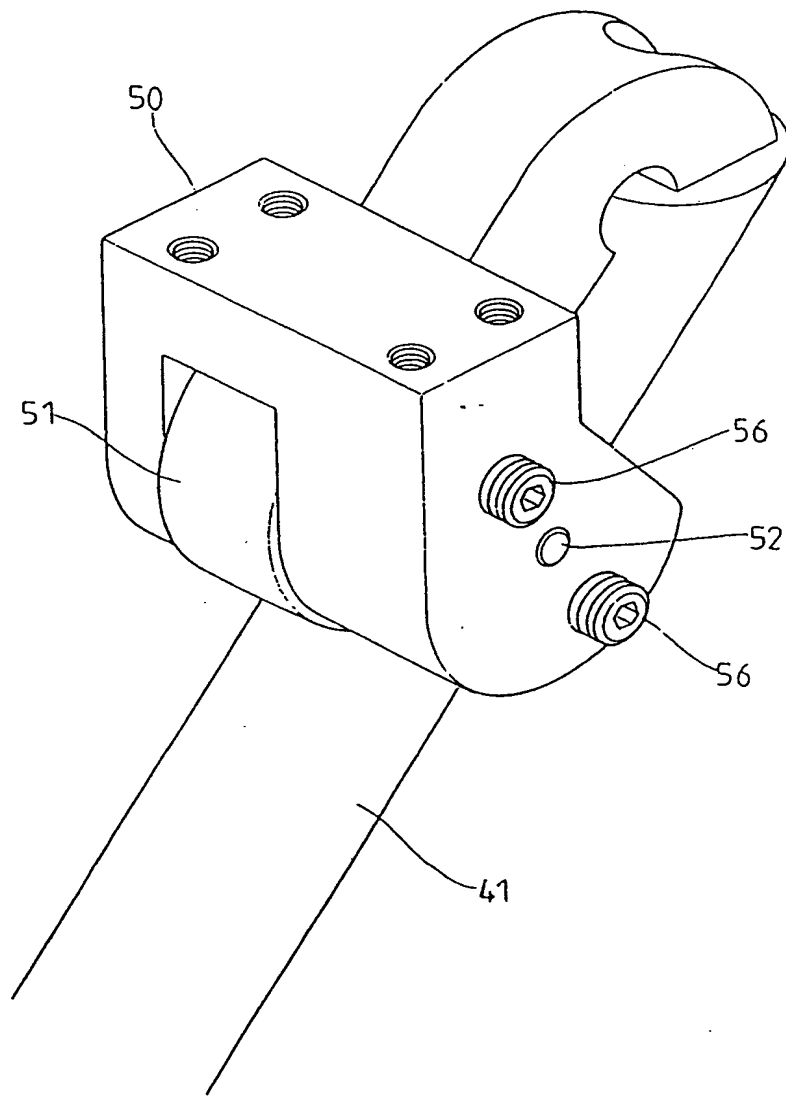


FIG. 9

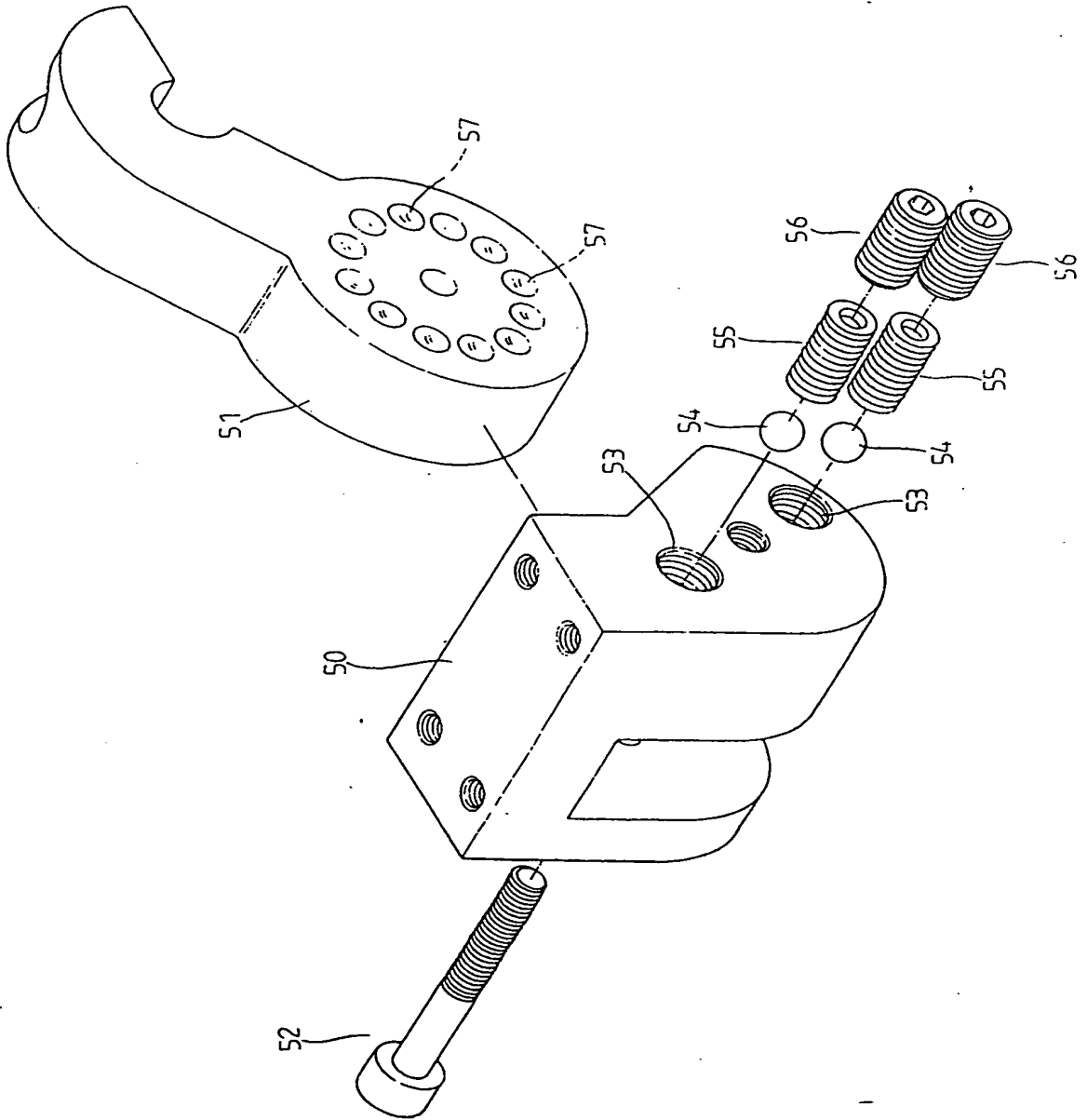


FIG. 10

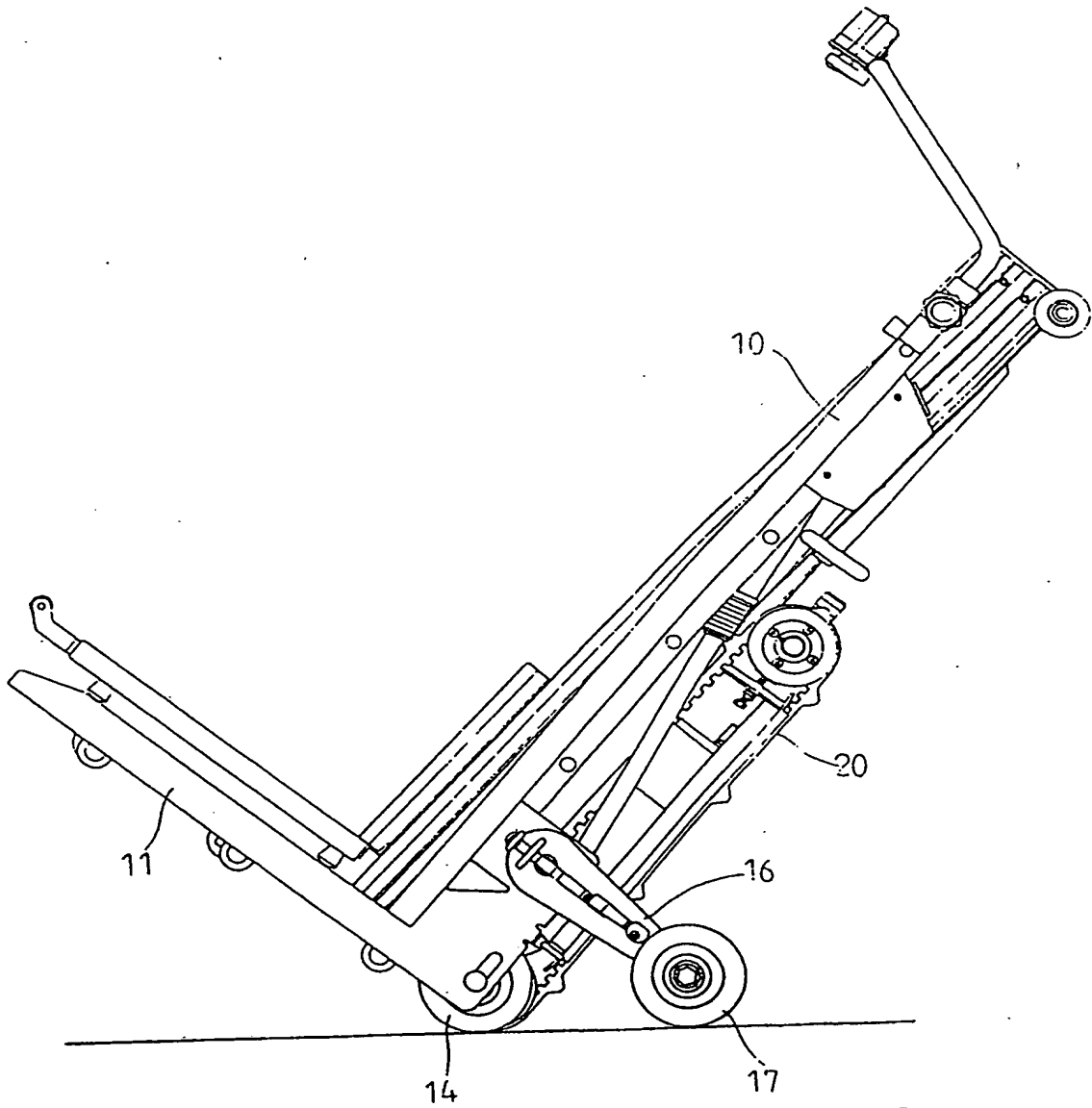


FIG. 11

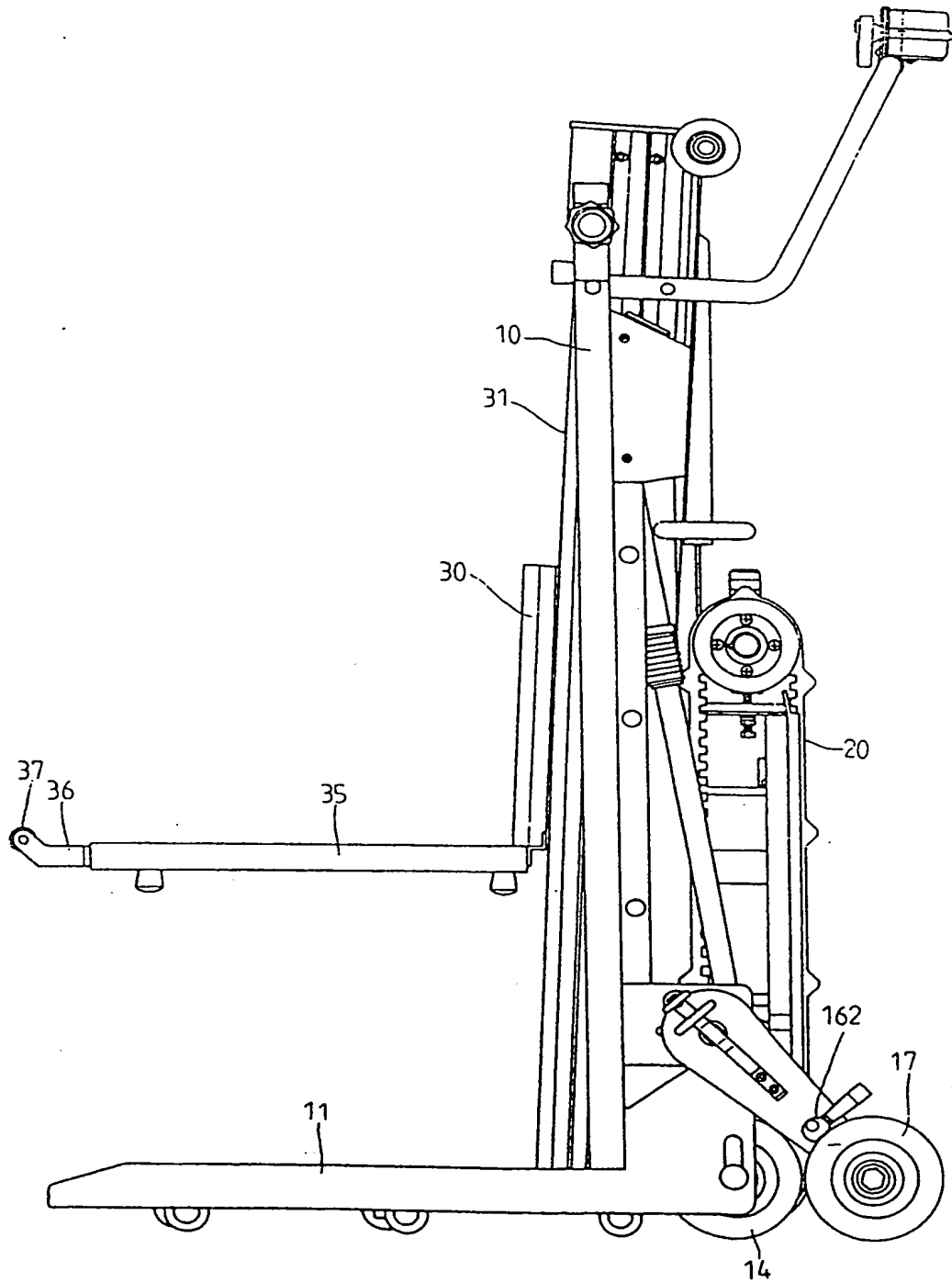
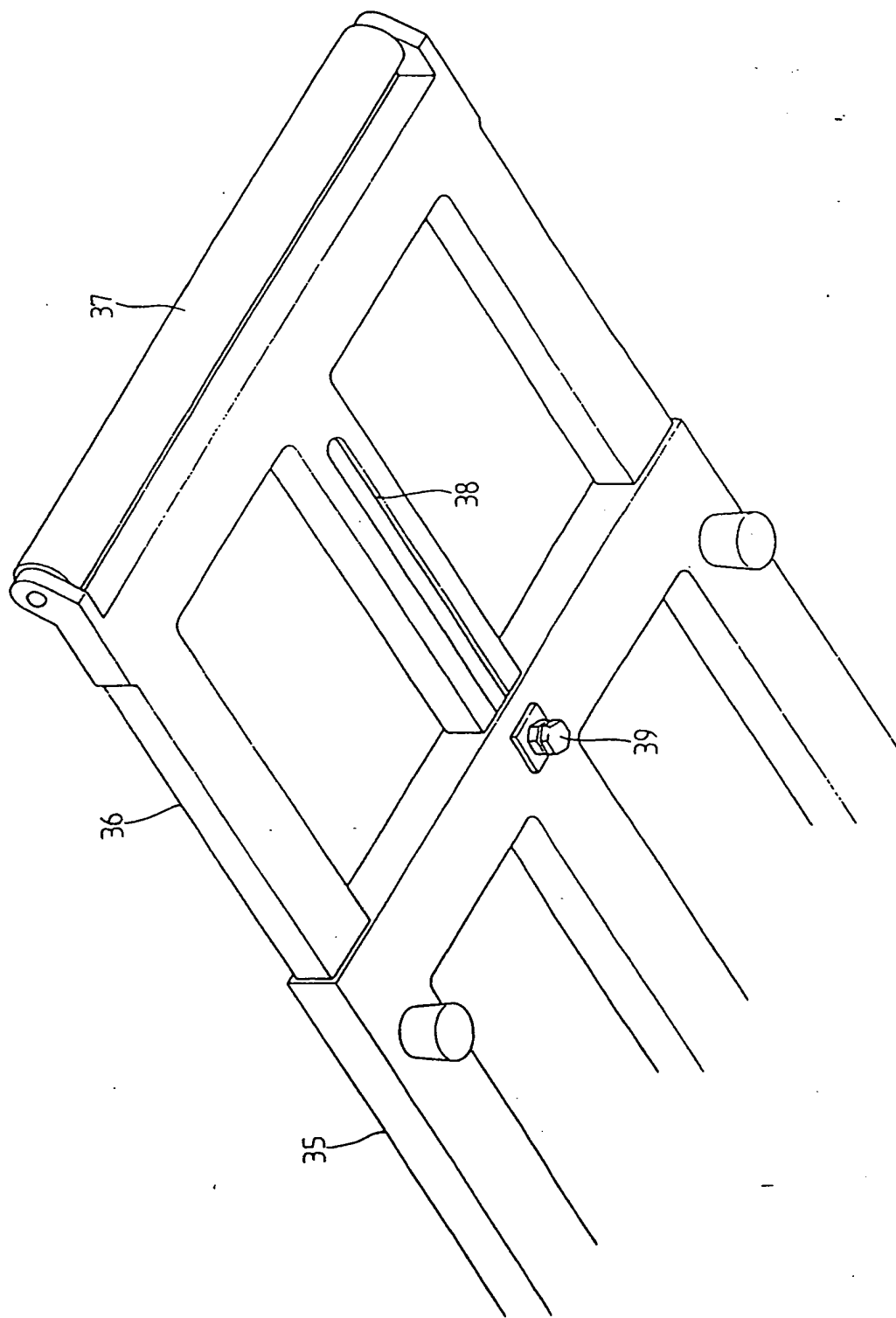
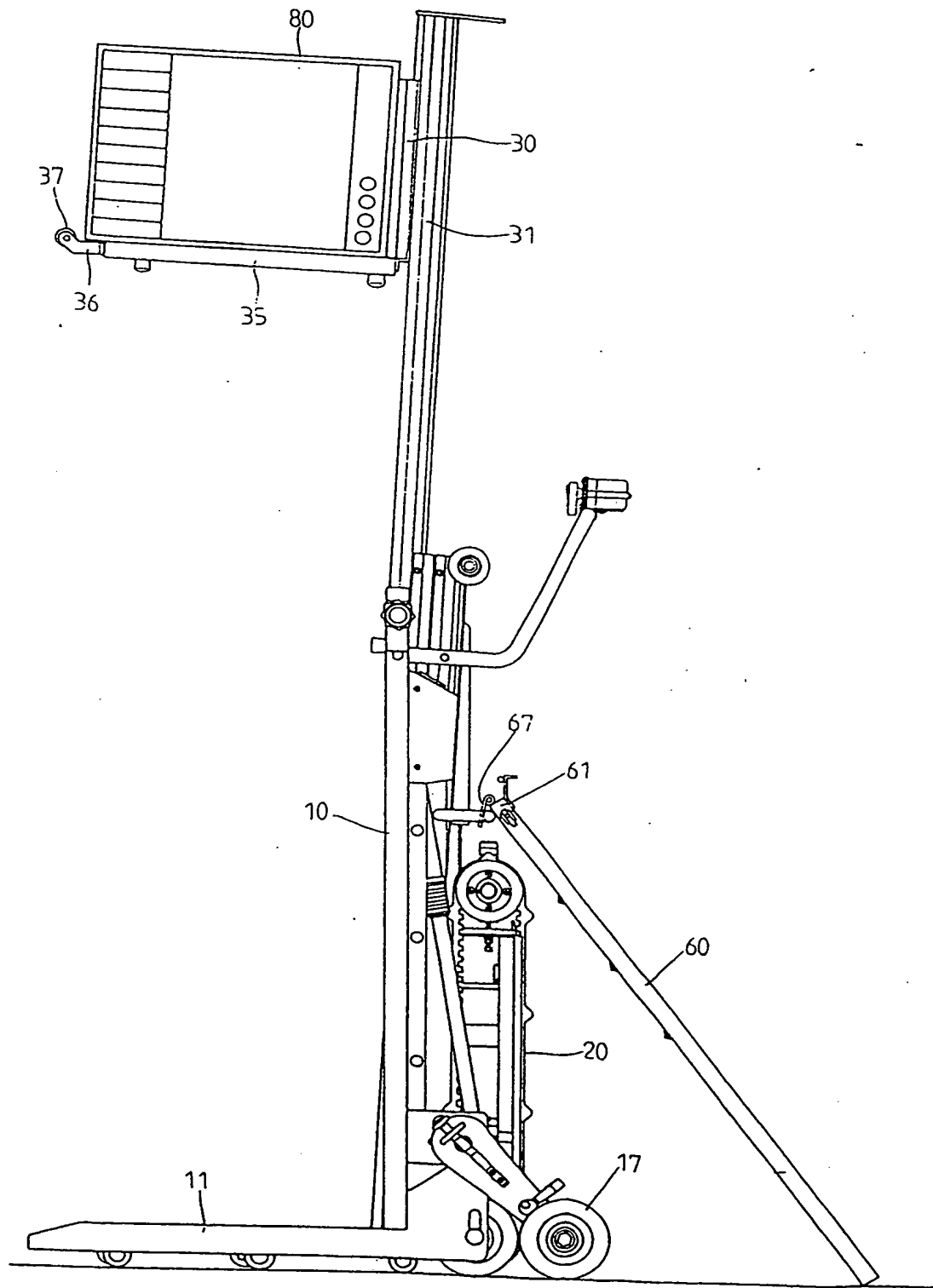


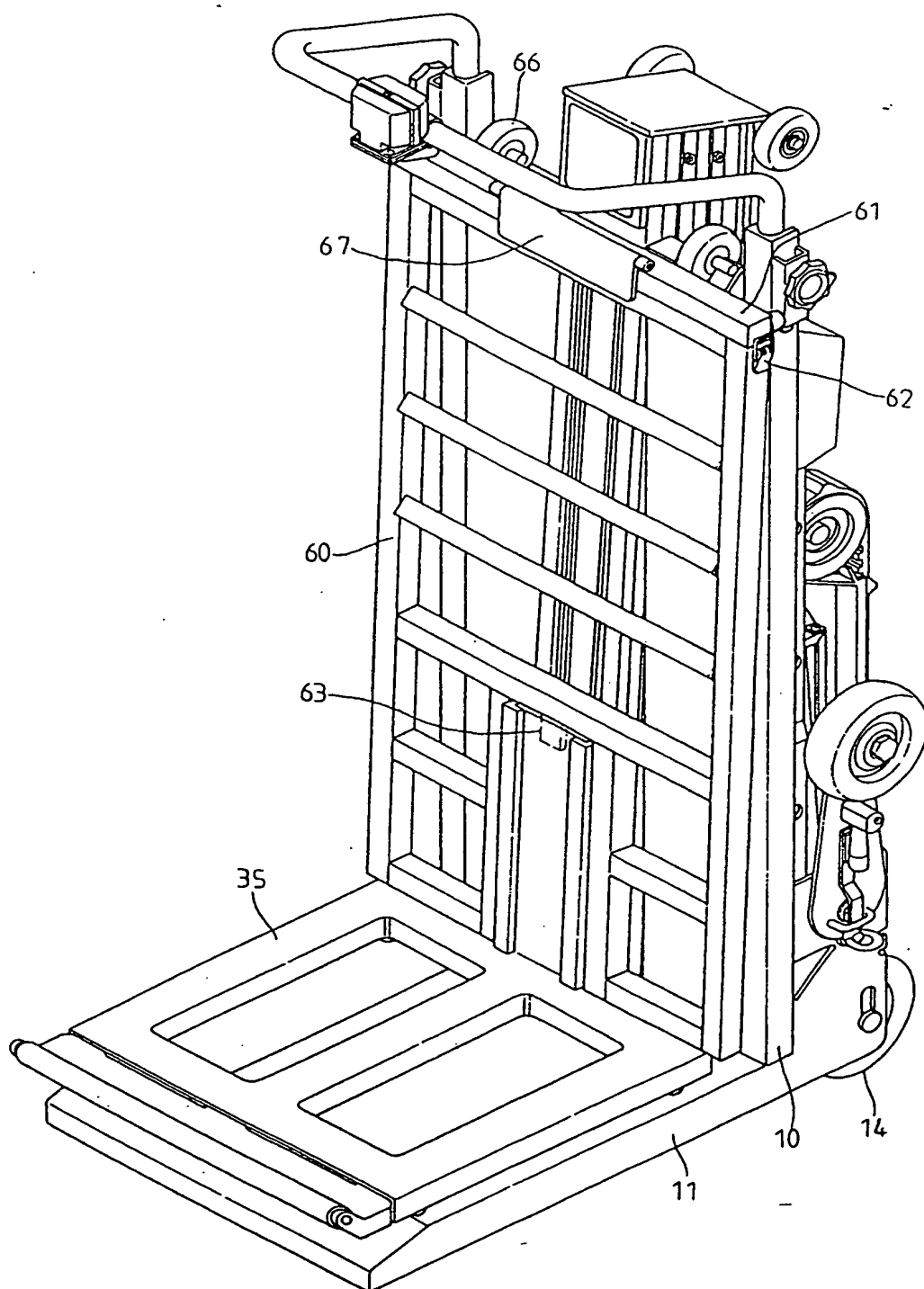
FIG. 1 2



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FIG. 13

**FIG. 1 4**

**FIG. 15**

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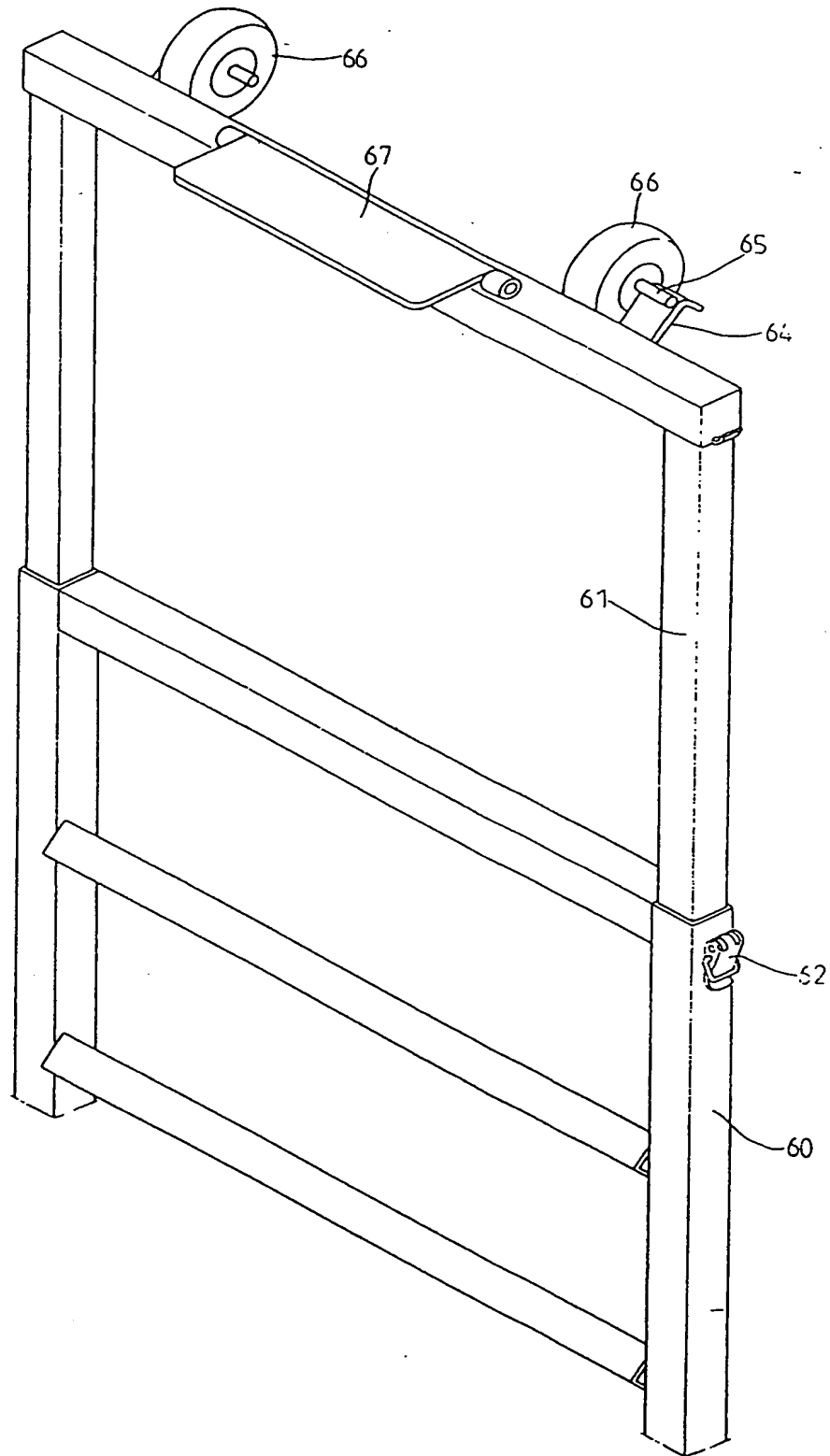


FIG. 1 6

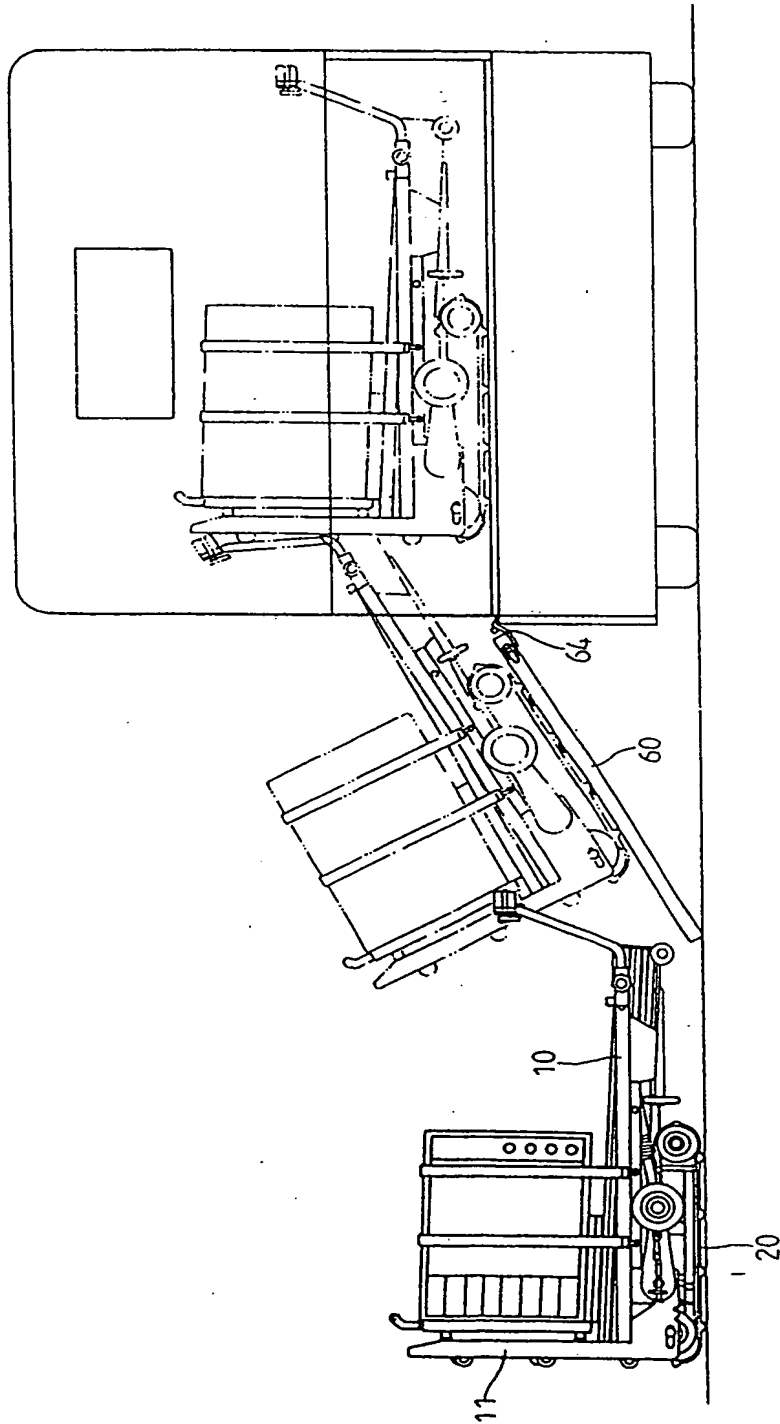


FIG. 17

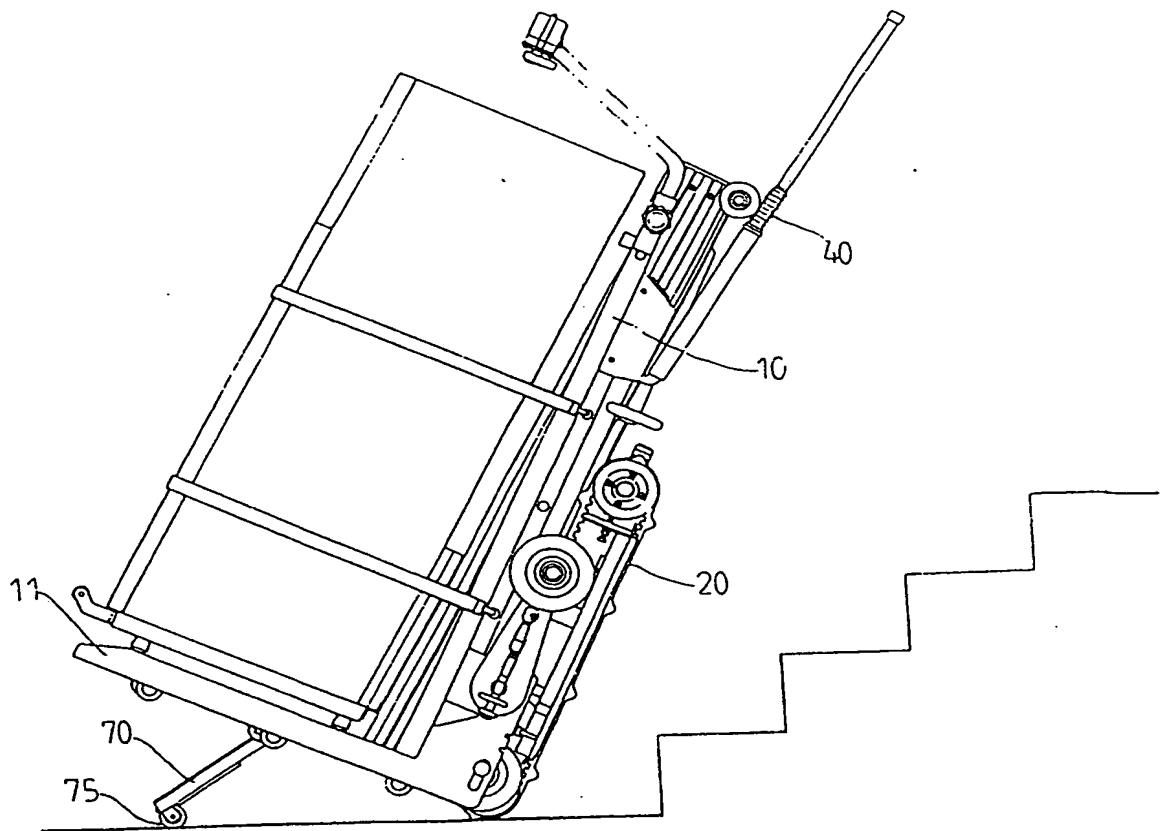


FIG. 18

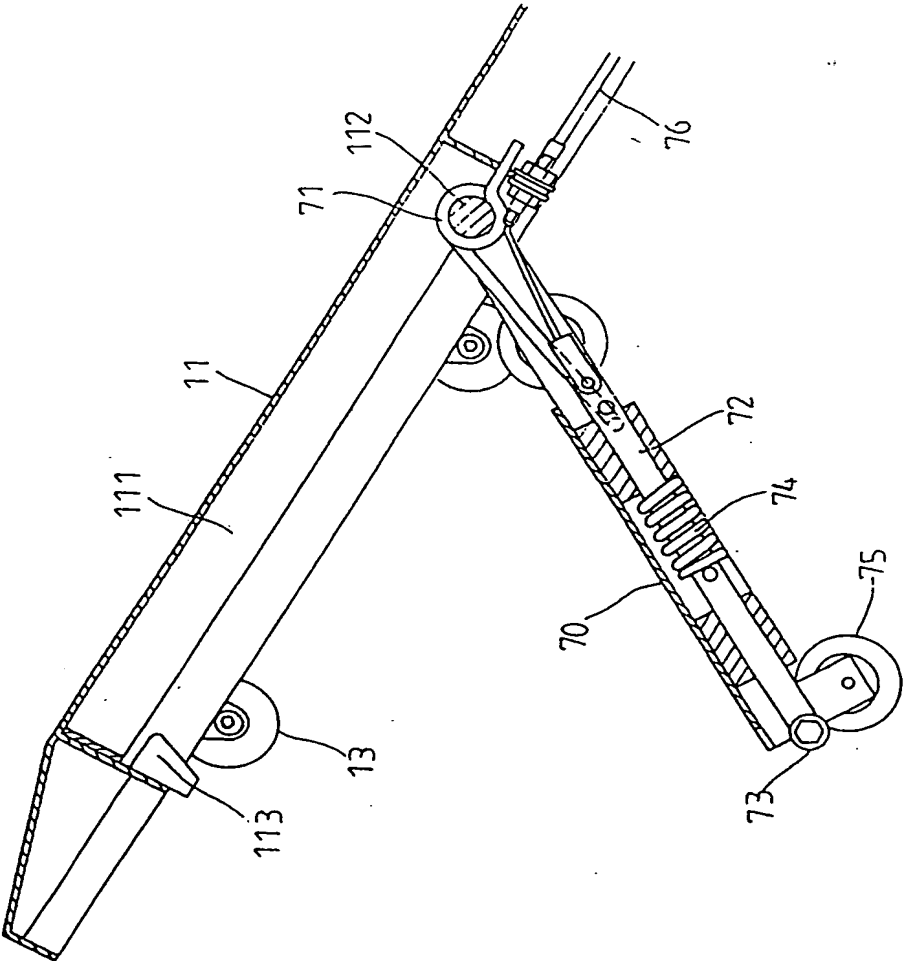


FIG. 19

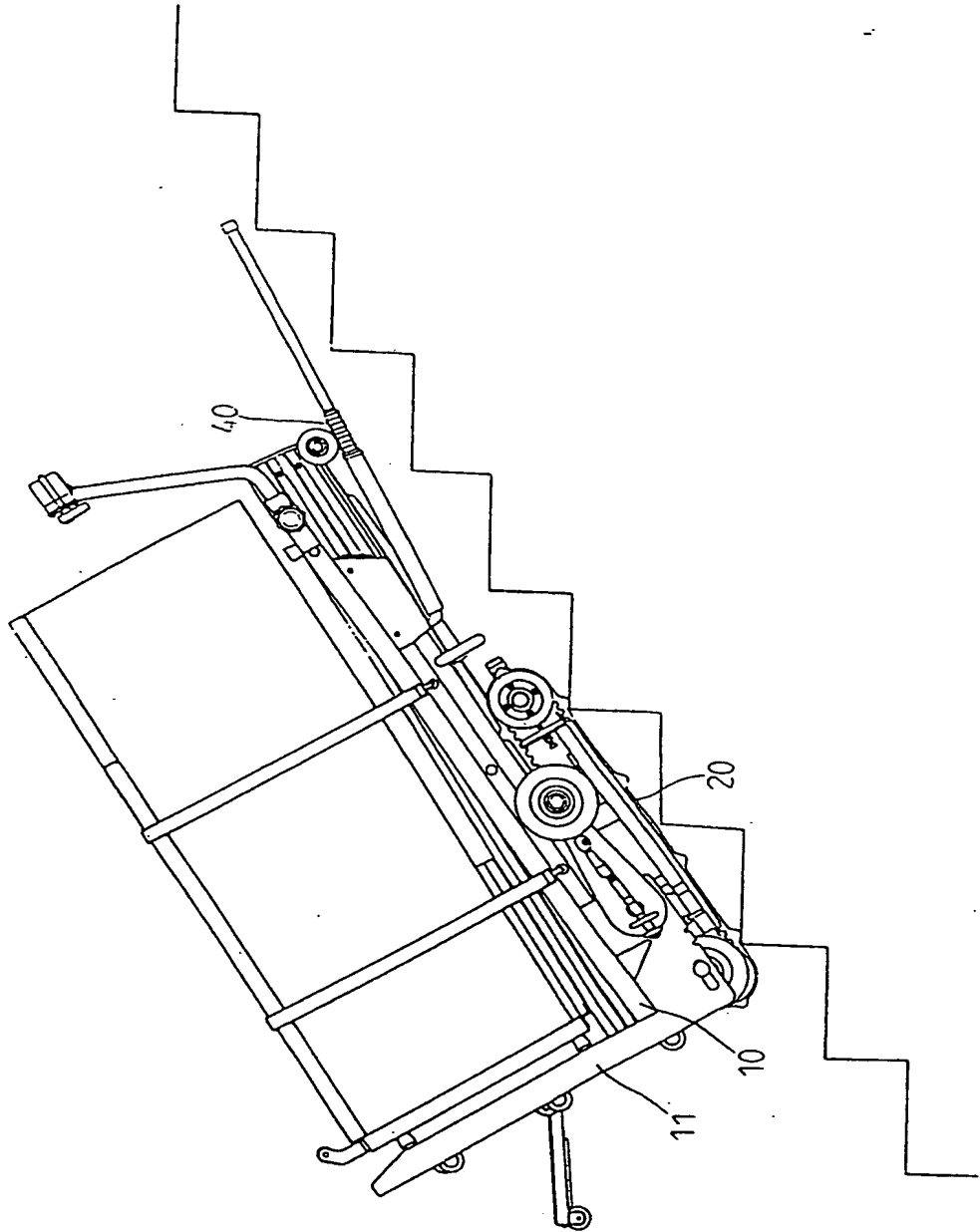


FIG. 20

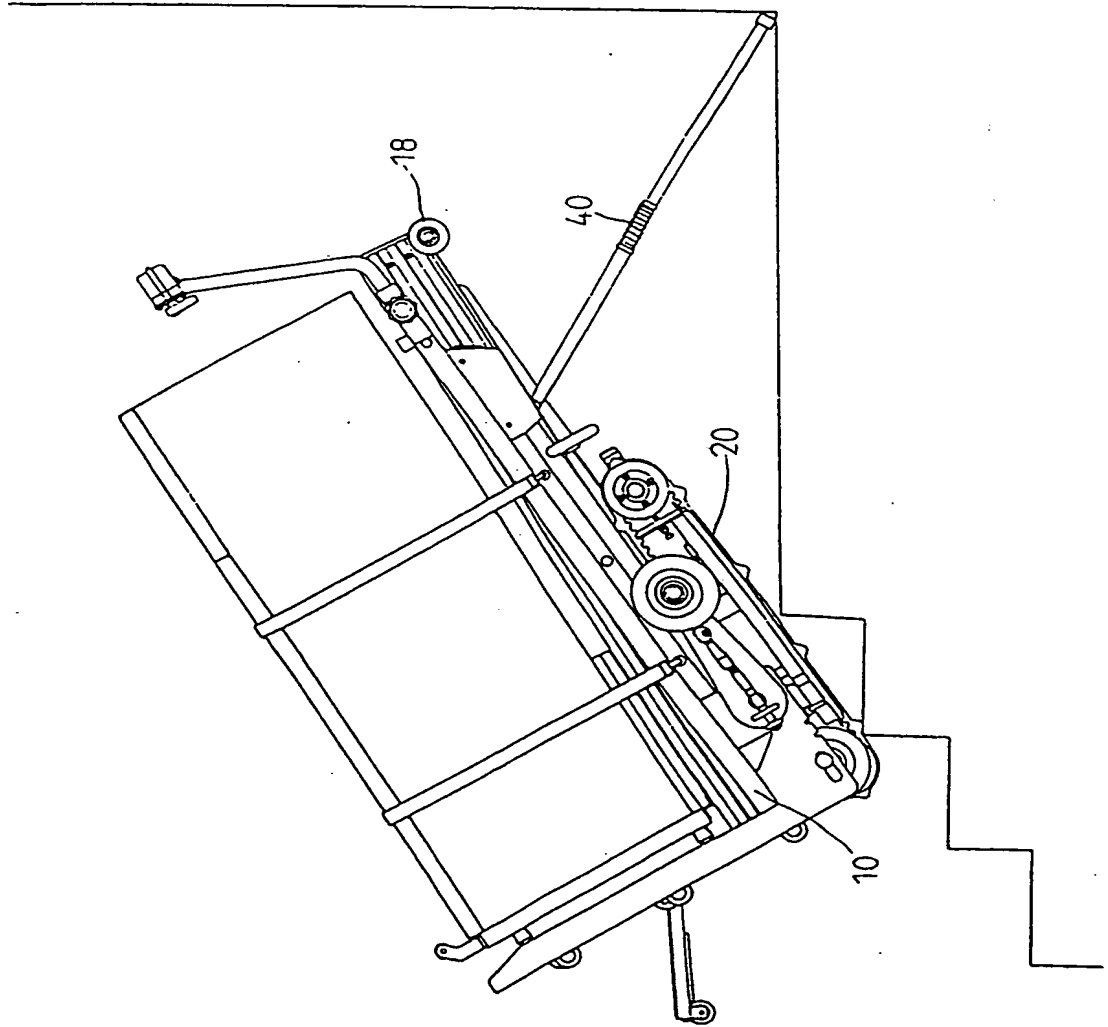


FIG.21

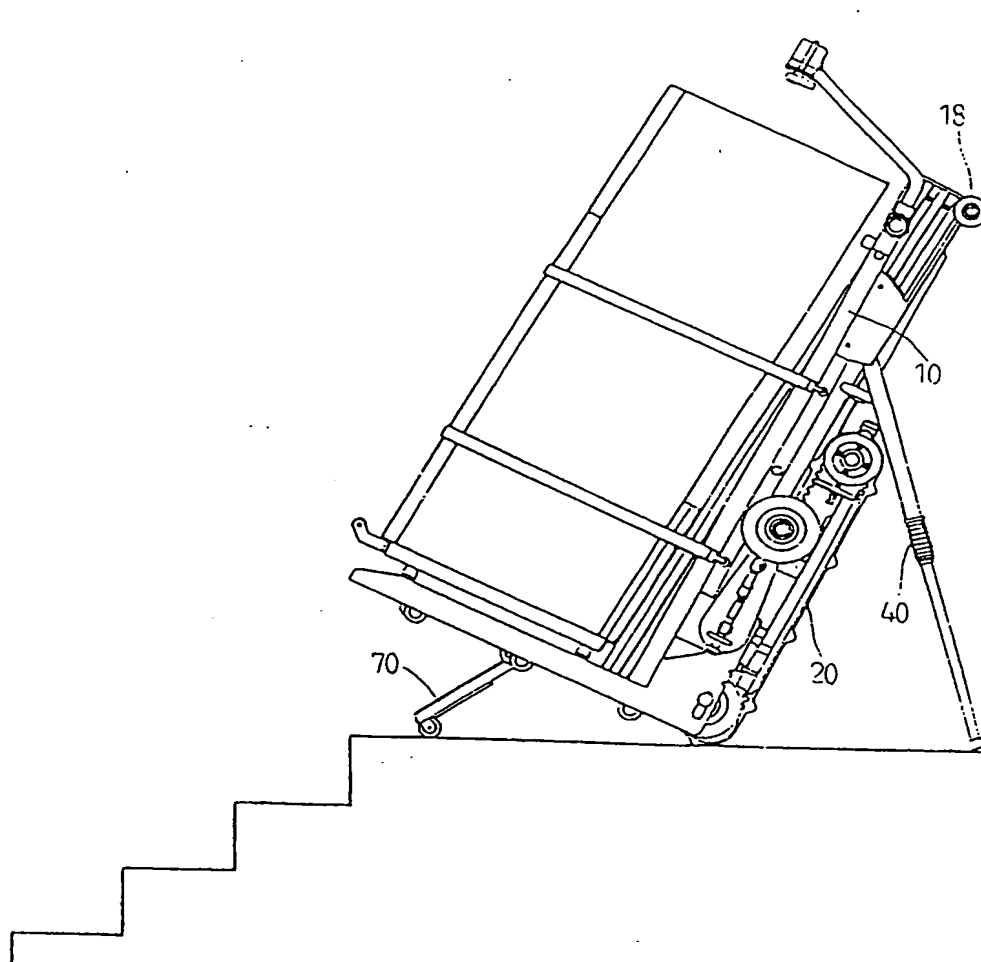


FIG. 22

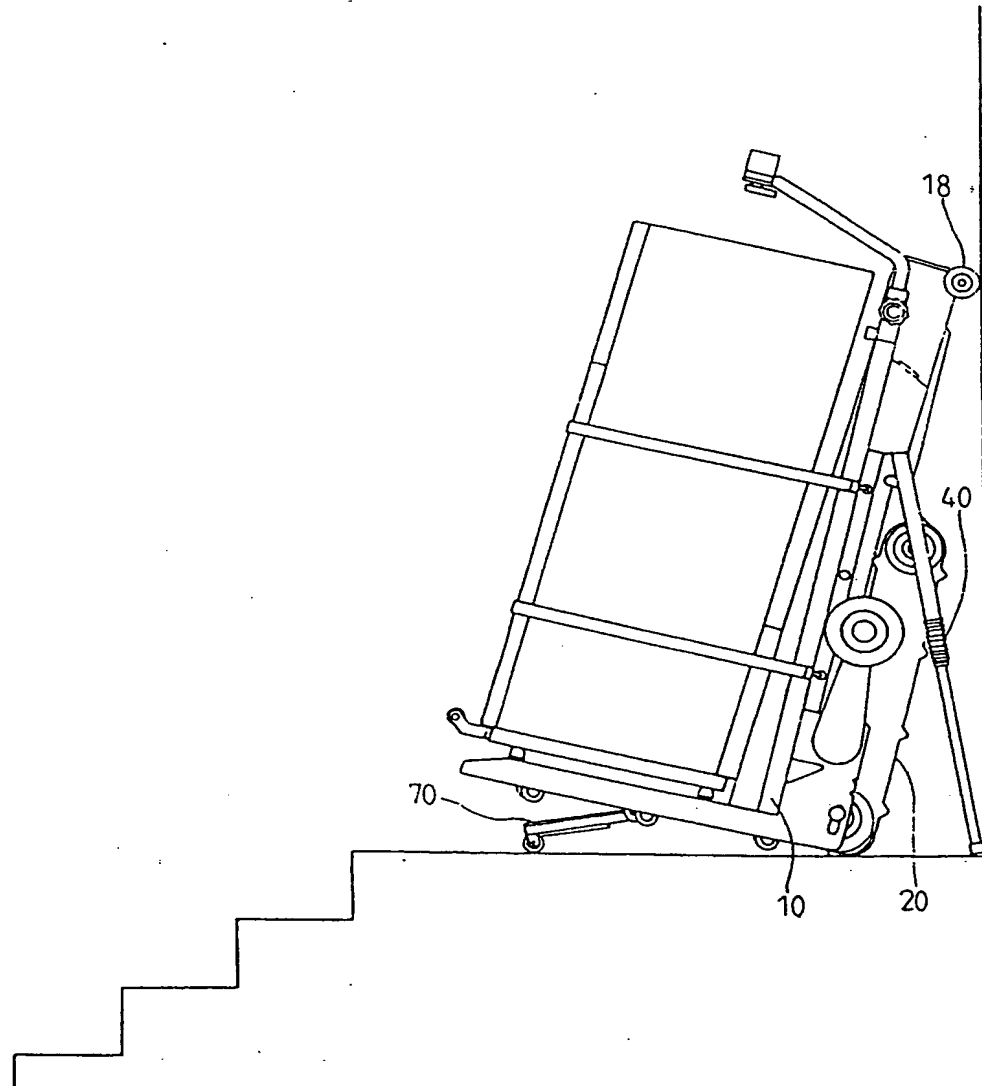
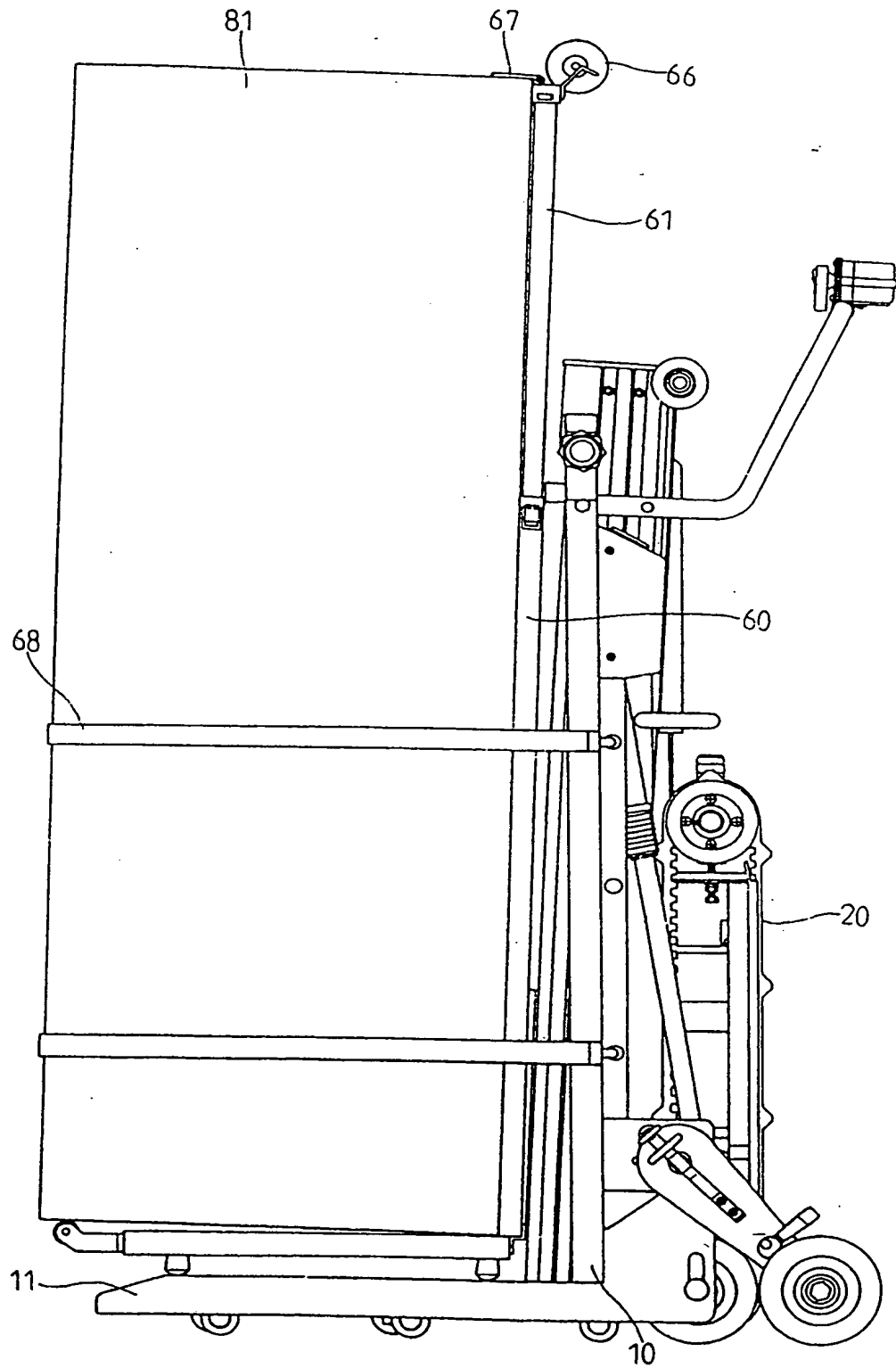


FIG. 23

**FIG. 24**